REMARKS

Claims 1-15, 17, and 29-35 are pending.
Claims 15, 24, and 32 are presently amended. A basis for this amendment is, e.g., paras. 0012, 0035, 0078, 0080, and Figure 2. "Channeled insert" finds a basis, e.g., in paras. 0042, 0043, 0060, 0072, 0076, and Figs. 2-4.
Claims 15, 17, 19-28, and 32-35, are rejected.
Claims 1-14 and 29-31 are withdrawn.
Claims 36 and 37 are new.
No new matter is added by way of this amendment.

Applicant thanks the Examiner, in the "Applicant-Initiated Interview Summary" of January 23, 2012, for acknowledging one viable approach, namely to amend the claims such that the path of the feed stream is defined more clearly to overcome Wieland.

A. Applicable case law on anticipation

The reference must teach every element of the claim. "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

B. Applicable case law on obviousness

The factual inquiry under *Graham v. John Deere*, 383 U.S. 1, 148 USPQ 459 (1966), includes the following:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.

C. Claim rejections under 35 USC §102(b) (anticipation)

The Examiner rejected Claims 15, 17, 24-28, and 32-33, under 35 USC §102(b), in view of Wieland (US 2004/0063577).

i. Claims 15 and 32

The following responds to the rejections of independent Claims 15 and 32 (pages 2-3 of Office Action).

The Office Action suggested that Wieland discloses the following elements:

(a) A single hydrogen reactor chamber;

(b) A plurality of steam reformation catalysts in the single hydrogen reactor chamber, to form a staged configuration;

(c) The staged configuration comprising a series of distinct zones or portions;

(d) Each zone is in physical contact with at least one other zone, and each zone contains at least one steam reformation catalyst;

(e) A feed stream passed in the reactor chamber is exposed to the catalysts in a predetermined sequential manner;

(f) The plurality of steam reformation catalysts includes:

- a high-activity steam reformation catalyst,
- a coke-resistant steam reformation catalyst, and
- a steam reformation catalyst that promotes a water-gas shift reaction.

(a) Zones or portions in series

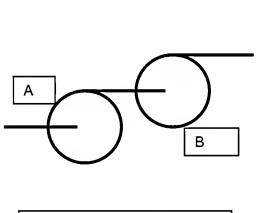
Applicant respectfully disagrees with the contention that Wieland discloses, "a series of distinct zones or portions" (page 2, line 21, and page 4, line 4, Office Action).

Applicant respectfully points to the argument from the earlier Response (August 29, 2011), regarding the definition of the word, "series." "Series" is defined by *Dictionary of Engineering Terms*.[1] According to the *Dictionary of Engineering Terms*, a series is, "[a] method of connecting the elements of an electrical circuit . . . so that current flow is common to all the elements of the circuit . . . [i]f one circuit element fails, the circuit is

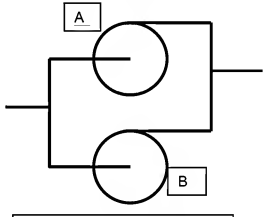
[1] Timings, R.L., and Twigg, P. (2001) The Pocket Illustrated Dictionary of Engineering Terms, Butterworth Heinemann, Oxford, UK, page 265.

broken and the current flow ceases in all the circuit elements." Applicant submits that this particular definition of "series," while it resides in the context of electric circuits, "series" has the same meaning, as understood by the skilled artisan in the chemical engineering arts. Page 495 of *Engineering Fluid Mechanics*, 9th edition, by C.T. Crowe, et al, discloses a first diagram of two pumps that are connected in series, and a second diagram showing two pumps connected in parallel.

Drawings of a sequential design (two pumps) and parallel design (two pumps), in chemical engineering, are reproduced below. These drawings have been annotated, they are reproduced from figure 14.17 (page 495) of *Engineering Fluid Mechanics*. The sequential (series) nature of the present invention is shown in Figure 2 of the instant specification, where the sequential or series aspect of the disclosure as set forth in the amended claims is delineated by the numbers, (**200**), (**202**), and (**204**).



SERIES DESIGN of Chellapa



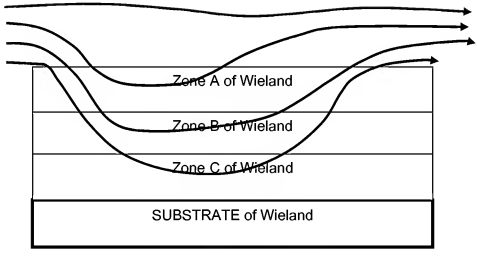
PARALLEL DESIGN encompassed by Wieland

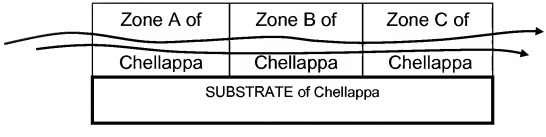
The Wieland reference presents a parallel design wherein fluid can flow to "A" and "B" bypassing either "A" or "B". Chellappa discloses a series design, as is required by Claims 15 and 32, fluid must pass from "A" to "B". Accordingly, Claims 15 and 32 are in condition for allowance as are the claims which depend from claims 15 and 32. Withdrawal of the rejection is courteously solicited.

(b) Failure to require passage through all zones (Wieland) versus requirement for passage through all zones (present claims)

Applicant submits that all of the independent claims require that all of the feed stream that passes through first zone must also pass through the second zone before passing through the outlet. This requirement is inherent in the required series arrangement. For embodiments with three zones, where the flow of gas is first through zone 1, then through zone 2, and finally through zone 3, the claims require that all of the feed stream that passes through the first zone must also pass through the second zone before passing through the outlet, and also require that all of the feed stream that passes through the first zone must also pass through the third zone before passing through the outlet. These requirements are found in all of the independent claims, and are more highly and more expressly defined in new Claims 36 and 37.

The failure of Wieland to require an ordered, sequential passage is set forth by the drawings below. The requirement of the present claims to require this ordered, sequential passage is also illustrated by these drawings. The drawing of the CHELLAPPA series embodiment, was re-drawn from Fig.2 of CHELLAPPA. For the Examiner's convenience, Fig.2 of CHELLAPPA is reproduced below. New Claims 36 and 37 contain an emphasized and more explicit requirement for this ordered, sequential passage.


Zone A of Wieland
Zone B of Wieland
Zone C of Wieland
SUBSTRATE of Wieland


Zone A of
Chellappa
Zone B of
Chellappa
Zone C of
Chellappa
SUBSTRATE of Chellappa

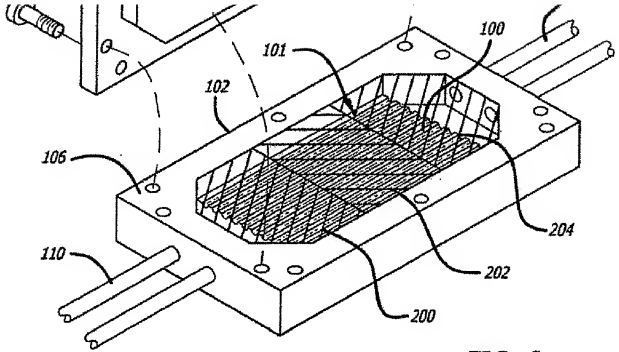


FIG. 2

(c) Passing over zones (Wieland) versus passing through zones (present claims)

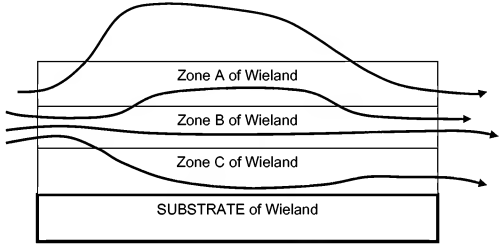
Wieland is not consistent with a series arrangement, because of its expressed and assertions that the gas flow of Wieland is **passed over** the catalyst. These expressions in Wieland's US 2004/0063577 appear in Wieland's Abstract, para. 0027, par. 0034, para. 0051, para. 0054.

The recitation in para. 0034, for example, is as follows.

- "is **passed over** a multilayer catalyst . . . the product mixture is **passed over** a single multilayer catalyst" (para. 0034 of Wieland's US 2004/0063577);

Wieland's US 7,150,866 discloses that the feed mixture is passed over the catalyst at, col. 1, lines 8-11, of Wieland's US 7,150,866; col. 3, lines 53-55; col. 6, lines 42-43; col. 7, lines 46-48; col. 8, lines 14-16; and col. 8, lines 15-16, of Wieland's US 7,150,866.

Wieland's description of feed gas passing over a catalyst is also consistent with the following configuration (see drawing below). In other words, some of Wieland's examples are consistent with the following drawing, where gas flows into the multi-layer catalyst, and where the flow of the gas is, in fact, "over" a catalyst (as is shown in the drawing below). Applicant's claims exclude the configuration of the following drawing.



(d) Coke-resistant steam reformation catalyst

Independent Claims 15 and 32 also contain the limitation of a coke-resistant steam reformation catalyst. Wieland fails to disclose a "coke-resistant steam reformation catalyst," (page 2, line 27, Office Action), referring to paras. 0038, 0039, 0044, and 0047 of Wieland (US 2004/0063577) identified by the Examiner as making such a disclosure

Applicant respectfully points out that paras. 0038, 0039, 0044, and 0047 of Wieland do not disclose "coke" or "coking." Para. 0038 of Wieland, for example, refers to platinum catalysts. However, this type of catalyst, as disclosed in Wieland, is not a disclosure of a "coke-resistant steam reformation catalyst." Please note that US 8,071,063 of Reyes et al, and US 4,261,810 of McHale et al, expressly refer to the **problem of coking of platinum** catalysts. Thus, Wieland's disclosure of "platinum" is not a disclosure of "coke-resistant steam reformation catalyst."

Applicant submits that the rejection of Claims 15 and 32, and against all claims which depend from Claims 15 and 32, have been overcome. Withdrawal of the rejection is respectfully requested.

(e) Column 6 (lines 9-22) of Wieland disclose are contrary to a series staged catalysts.

In Wieland at col. 6, lines 9-22, what is disclosed an upper layer of catalyst, a lower layer of catalyst, where the "lower layer is applied over the total length L of the support body." This layering is not compatible with **series** as consistently used and applied in the Specification of the instant application. The layers of Wieland are lying on top of each other, where these layers traverse the entire body of the substrate. Thus, the Wieland device is a parallel configuration. Because of Wieland's repeated and consistent disclosure that layers are applied on top of each other, traversing the entire length of the substrate, it is the case that Wieland's configuration is not in a series, but instead is a parallel configuration.

(f) Column 7 (lines 63-67) to Column 8 (lines 1-10) of Wieland do not disdclsoe a series staged catalyst.

Wieland (col. 7, lines 63-67) discloses layers that are lying on top of each other. Wieland states that the gas is "passed together over the catalyst." But is not a disclosure of the limitation that the gas passes, sequentially, through a series of staged catalysts . Claims 15 and 32 require a "series" conformation.

Accordingly, Applicant submits that the grounds for rejection have been removed. Withdrawal of the rejection is respectfully solicited in earnest.

(g) Channeled insert

Applicant submits that Claims 15 and 22, as currently amended, require a "channeled insert," and further contends that the cited art fails to disclose a channeled insert. Accordingly, Applicant concludes that the grounds for rejection of the claims has been removed, and respectfully request allowance of Claims 15 and 22, and claims which depend from Claims 15 and 22.

ii. Claim 17

Applicant submits Wieland fails expressly to disclose, "coke-resistant steam reformation catalyst." The terms "coke" or "coking" do not occur in Wieland. Moreover, Wieland fails to disclose that a coke-resistant catalyst is located at any entrance to a chamber.

On this basis, Applicant submits that the grounds for rejecting Claim 17 have been removed. Withdrawal of this rejection is solicited in earnest.

iii. Claim 24

Wieland fails to disclose that gas is first exposed to a first catalyst, where this exposure is necessarily followed by exposure of the gas to a second catalyst. Wieland does not disclose that a first type of catalyst is loaded at an entrance of a reformer, where

this is followed by a second type of catalyst, that is, where the second type of catalyst is not at the entrance.

In other words, the language of Claim 24 means that a first catalyst is loaded at an entrance, where this first catalyst is followed by a second catalyst, where the second catalyst is not located at the entrance.

Wieland fails to disclose **any sequential arrangement**. Rather, Wieland discloses an arrangement of catalysts not staged serially but staged in a layered or parallel arrangement.

D. Claim rejections under 35 USC §102(e) (anticipation)

The Examiner rejected Claims 15, 17, 19-20, 24-28, and 32-33, under 35 USC §102(e), in view of Wieland (US 7,150,866) (page 3 (lines 19-20) to page 5 (line 10) Office Action).

Applicant respectfully refers to all of the arguments presented above, in the rebuttal of the rejection that was in view of Wieland's US 2004/0063577 and against Wieland's US 7,150,866. Applicant contends that the grounds for rejection have been removed, and respectfully requests allowance of the claims.

In particular, Applicant submits that Claims 15 and 22, as currently amended, require a "channeled insert," and further contends that the cited art fails to disclose a channeled insert. Accordingly, Applicant concludes that the ground for rejection of the claims has been removed, and respectfully request allowance of Claims 15 and 22, and claims which depend from Claims 15 and 22.

/ / /

E. Claim rejections under 35 USC §103 (obviousness)

i. Obviousness rejection over Wieland

The Examiner rejected Claims 21-23 under 35 USC §103 as obvious over Wieland (U.S. Pat. No. 7,150,866) (page 5, lines 11-24, Office Action). Applicant respectfully disagrees, in view of the above arguments.

To summarize, the present claims are not obvious over Wieland, or over Wieland in combination with Hwang, because:

(1) The present claims require a series of zones;

(2) The present claims require a channeled insert;

(3) The present claims a coke-resistant steam reformation catalyst;

(4) The present claims require, "wherein a feed stream passed in the reactor chamber is passed through the zones or portions and is exposed to the plurality of catalysts in a predetermined sequential manner, wherein the series of zones or portions comprises a first zone and a second zone in series, wherein an inlet introduces the feed stream to the first zone, wherein an outlet removes feed stream from the second zone, and wherein all of the feed stream that passes through the first zone must also pass through the second zone before passing through the outlet."

With specific regard to this obviousness rejection, Wieland discloses an advantage of Wieland's *parallel layered* configuration to prevent high-temperature peaks. The recitation of this advantage teaches away from Applicant's claims, which use a staged series conformation. In detail, Wieland teaches away from Applicant's claims because Wieland identifies an advantage of the Wieland multi-layer catalyst involving upper layers and lower layers. The advantage of the upper layer/lower layer conformation of Wieland is preventing "high-temperature peaks which could destroy the catalyst." (col. 5, lines 43-53, Wieland). Wieland discloses utilizing upper and lower layers, stacked on top of each other, and which are contact with each other, where the advantage is to mitigate high-temperature peaks. In contrast, the zones of Applicant's claimed invention avoid Wieland's configuration of upper and lower layers.

Applicant contends that the skilled artisan, faced with Wieland's problem of high-temperature peaks, would not have used Applicant's series configured, zoned catalyst. Applicant submits that the grounds of rejection have been removed, and allowance is solicited in earnest.

Furthermore, Applicant submits that Claims 15 and 22, as currently amended, require a "channeled insert," and further contends that the cited art fails to disclose a channeled insert.

Accordingly the grounds for rejection of the claim have been overcome, and Applicant respectfully requests allowance of Claims 15 and 32, and claims which depend from Claims 15 and 32.

Accordingly, Applicant concludes that the grounds for rejection of these claims, and the grounds for rejection of all dependent claims, have been removed, and respectfully request allowance of Claims 15 and 22, and claims which depend from Claims 15 and 22.

ii. Obviousness rejection over Wieland in view of Hwang

The Examiner rejected Claims 34-35 as obvious under Wieland (US 7,150,866) in view of Hwang (US 6,436,363) (page 6 of Office Action).

Applicant submits that independent Claim 32 requires a configuration of zones that is "in series," and that the gas is passed "through" the zones or portions. In striking contrast, Wieland does not have an "in series" conformation of zones, and Wieland's gas is "passed over" (not through) the catalysts. Hwang does not correct for these deficiencies of Wieland. It is the case with the Wieland device, and also with the Hwang device, that the gas can contact the upper layer, but fail to pass through one or more of the lower layers. This type of failure is prevented by the series configuration, as disclosed (e.g., Fig. 2 of Applicant) and claimed by Applicant.

Regarding the requirement of Claim 34 for a gradient, Applicant submits that the gradient of Claim 34 resides in between the distinct zones in the series of zones that is required by the independent claim. In other words, Claim 34 incorporates the requirements of the independent claim for catalyst zones that occur in a series configuration.

Applicant submits that the grounds for rejection of Claims 34-35 have been overcome. Withdrawal of this rejection is hereby solicited in earnest.

iii. Obviousness rejection over Wieland in view of Hwang

The Examiner rejected Claims 34-35 as obvious under Wieland (US 2004/0063577) in view of Hwang (US 6,436,363) (page 6 of Office Action).

This basis of rejection, which is in view of the Wieland published application, is essentially identical to the basis set forth in view of the combination of Huang and the Wieland issued patent. Applicant refers the Examiner to the above-rebuttal against the combination of Huang and the Wieland issued patent. Applicant submits that the grounds for rejection of Claims 34-35 have been overcome. Withdrawal of this rejection is hereby solicited in earnest.

Conclusion

Applicant's current response is believed to be a complete reply to all of the outstanding issues of the latest Office Action. Accordingly, Applicant respectfully requests entry of the amendments, and reconsideration and passage of the amended claims to allowance at the earliest possible convenience.

The Commissioner is hereby authorized to debit any charges or refund any overpayments to Deposit Account No. **50-2036**.

If the Examiner believes that a teleconference would aid in the prosecution of this case in any way, please call the undersigned.

Date: May 21, 2012

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